



INNOLUX DISPLAY CORPORATION

TM315GW01 V.0 LCD MODULE SPECIFICATION

() Preliminary Specification

(●) Final Specification

Approved by	Checked by	Prepared by
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A. General specification

NO.	Item	Specification	Remark
1	Display resolution (pixel)	1,366(H) X 768(V), WXGA+ resolution	
2	Active area (mm)	697.685 (H) X 392.256(V)	
3	Screen size (inch)	31.5 inches diagonal	
4	Pixel pitch (mm)	0.51075 (H) X 0.51075 (V)	
5	Color configuration	R, G, B vertical stripe	
6	Overall dimension (mm)	760 (W) X 450 (H) X 45(D)	
7	Weight (g)	6000	
8	Surface treatment	Anti-glare, Haze=11%, Hard coating (3H)	Note 1
9	Input color signal	8 bit LVDS	
10	Display colors	16.7M	
11	Color saturation	72% NTSC	
12	Backlight	4U CCFL	
13	RoHS & Halogen free	RoHS & Halogen free compliance	

Note 1: Glare Option available

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B. Electrical specifications

1. Pin assignment

Connector

FOXCONN GS23302-1311S-7F or mechanical interface equivalent connector.

Pin No	Symbol	Description
1	VCC	+12V, DC, Regulated
2	VCC	+12V, DC, Regulated
3	VCC	+12V, DC, Regulated
4	VCC	+12V, DC, Regulated
5	GND	Ground and Signal Return
6	GND	Ground and Signal Return
7	GND	Ground and Signal Return
8	GND	Ground and Signal Return
9	LVDS Option	Low/Open for Normal (NS), High for JEIDA
10	Reserved	Open
11	GND	Ground and Signal Return for LVDS
12	RIN0-	LVDS Channel 0 negative
13	RIN0+	LVDS Channel 0 positive
14	GND	Ground and Signal Return for LVDS
15	RIN1-	LVDS Channel 1 negative
16	RIN1+	LVDS Channel 1 positive
17	GND	Ground and Signal Return for LVDS
18	RIN2-	LVDS Channel 2 negative
19	RIN2+	LVDS Channel 2 positive
20	GND	Ground and Signal Return for LVDS
21	RCLK-	LVDS Clock negative
22	RCLK+	LVDS Clock positive
23	GND	Ground and Signal Return for LVDS
24	RIN3-	LVDS Channel 3 negative
25	RIN3+	LVDS Channel 3 positive
26	GND	Ground and Signal Return for LVDS
27	Reserved	Open or High
28	Reserved	Open or High
29	GND	Ground and Signal Return
30	GND	Ground and Signal Return



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Top view of LVDS connector



Rear view of LVDS connector

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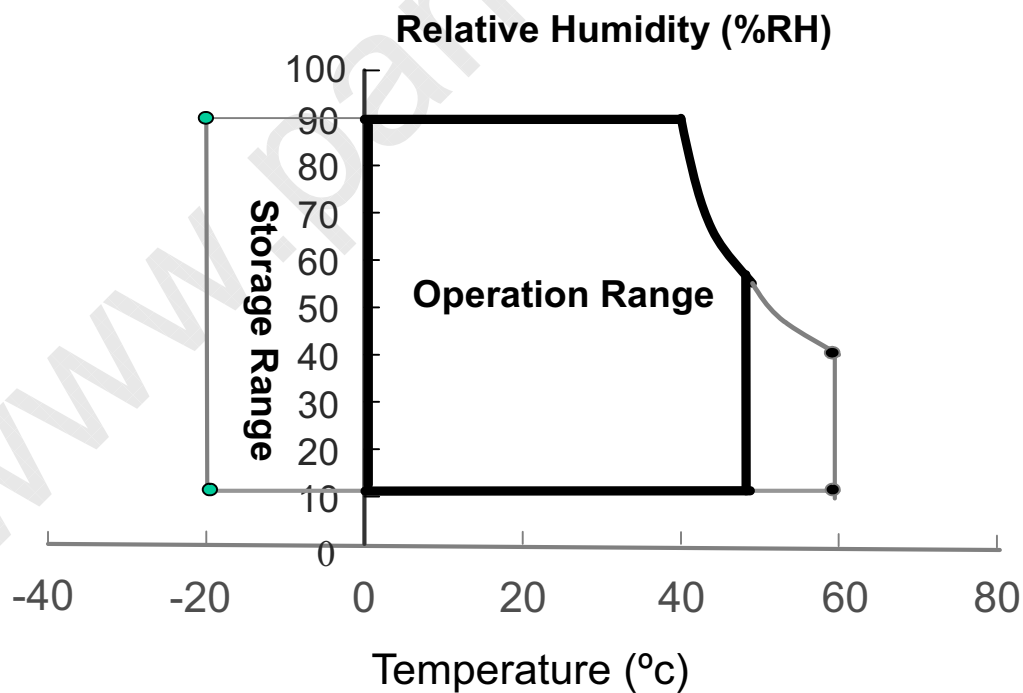
2. Absolute maximum ratings

Parameter	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
LCD drive voltage	V_{CC}	-0.3	-	14.0	V	At 25°C
Input signal voltage	V_{LH}	-0.3	-	3.6	V	At 25°C
BLU Input voltage	VDDDB	-0.3	-	28	V	At 25°C
Operating temperature	Top	0	-	50	°C	Note 1
Operating Humidity	Hop	10	-	90	%RH	
Storage temperature	T_{ST}	-20	-	60	°C	Note 2
Storage Humidity	H_{ST}	10	-	90	%RH	

Note 1: The relative humidity must not exceed 90% non-condensing at temperatures of 40°C or less.

At temperatures greater than 40°C, the wet bulb temperature must not exceed 39°C.

Note 2: The unit should not be exposed to corrosive chemicals.



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3. Electrical characteristics

a. Typical operating conditions

Item		Symbol	Min.	Typ.	Max.	Unit	Remark
LCD Input Voltage		V_{cc}	10.8	12	13.2	V	
LCD Permissive Power Input Ripple		V_{RF}	-	-	0.4	V	
LCD Input Current	Black	I_{cc}	-	300	400	mA	Note 1
	White	I_{cc}	-	450	550		Note 2
	Mosaic	I_{cc}	-	375	475		Note 3
Power Consumption		P_c	-	5.4	7.26	W	Note 2
LCD Rush Current		I_{Rush}	-	-	3	A	Note 4
Logic Input Voltage LVDS: IN+, IN-	Common Mode Voltage	VCM	1.10	1.25	1.40	V	
	Differential Input Voltage	VID	100	-	600	mV	
	Threshold Voltage (High)	VTH	-	-	100	mV	Note 5
	Threshold Voltage (Low)	VTL	-100	-	-	mV	Note 5

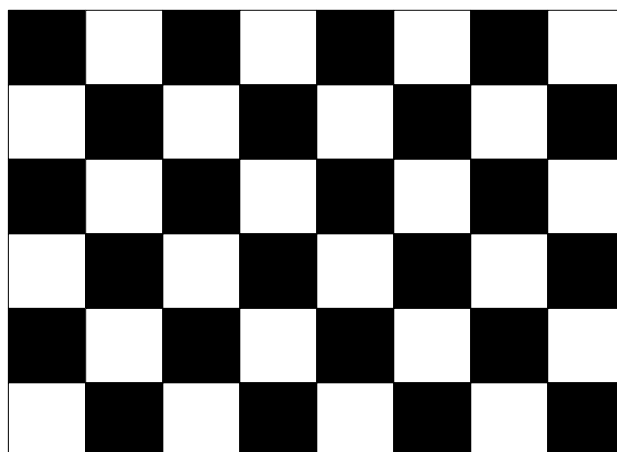
Note 1 : The specified current is under the $V_{cc} = 12V$, $25^{\circ}C$, $f_v = 60Hz$ (frame frequency) condition whereas black pattern is displayed.

Note 2 : The specified current is under the $V_{cc} = 12V$, $25^{\circ}C$, $f_v = 60Hz$ (frame frequency) condition whereas white pattern is displayed.

Note 3 : The specified current is under the $V_{cc} = 12V$, $25^{\circ}C$, $f_v = 60Hz$ (frame frequency) condition whereas mosaic pattern(black & white [8*6]) is displayed.

White : 255 Gray

Black : 0 Gray

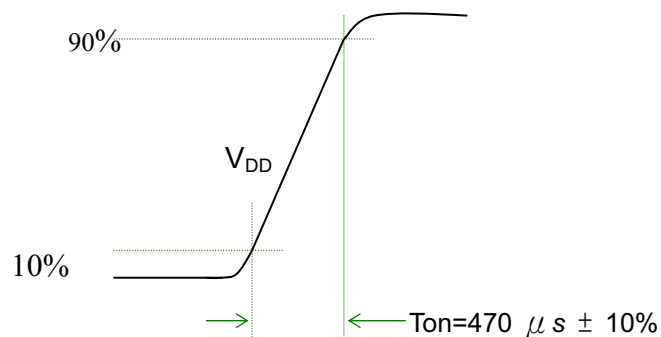


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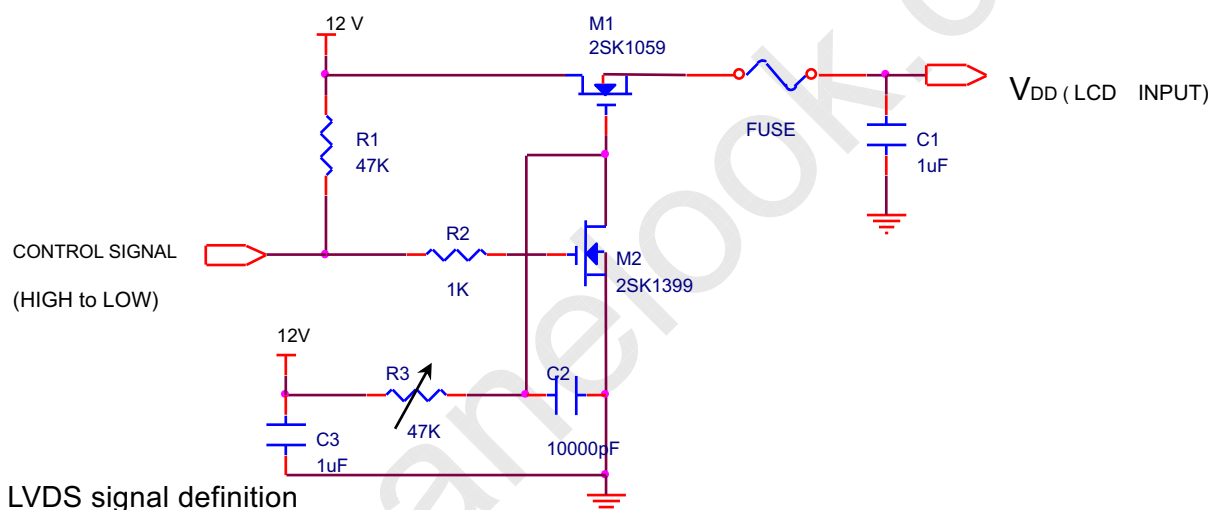
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Note 4 : test condition :

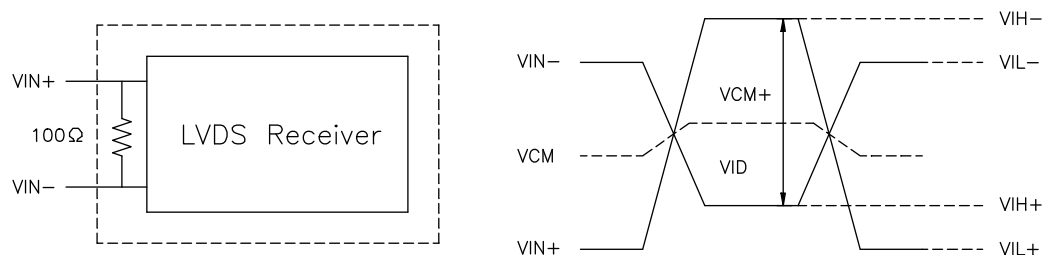
- (1) $V_{DD} = 12\text{ V}$, V_{DD} rising time = $470\text{ }\mu\text{s} \pm 10\%$
- (2) Pattern: Mosaic pattern



(3) Test circuit

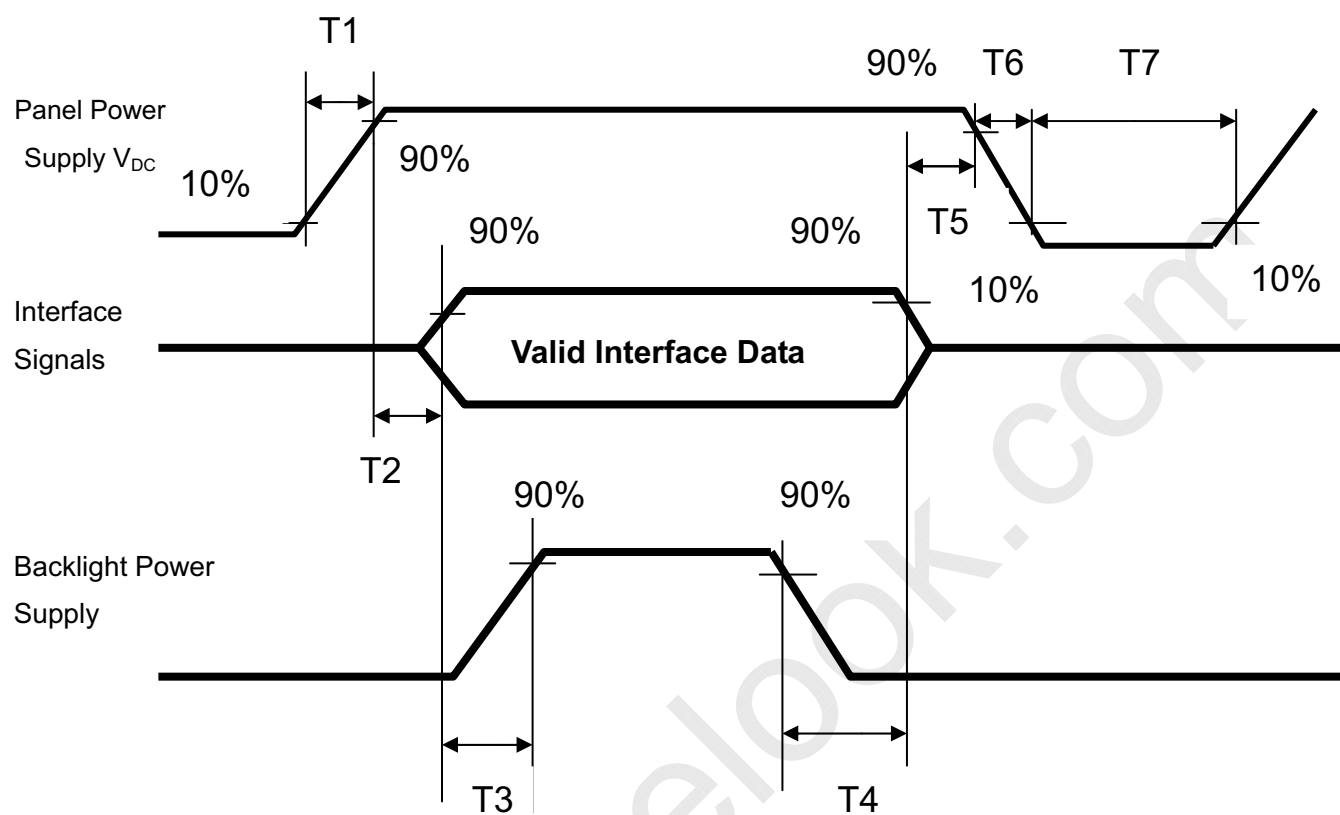


Note 5: LVDS signal definition

 $VIN+$ = Positive differential DATA & CLK Input $VIN-$ = Negative differential DATA & CLK Input $VID = VIN+ - VIN-$, $\Delta VCM = |VCM+ - VCM-|$, $\Delta VID = |VID+ - VID-|$, $VID+ = |VIH+ - VIH-|$, $VID- = |VIL+ - VIL-|$, $VCM = (VIN+ + VIN-)/2$, $VCM+ = (VIH+ + VIH-)/2$, $VCM- = (VIL+ + VIL-)/2$,

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Note 6 : Power on sequence for LCD V_{DD} 

Parameter	Value			Unit
	Min	Typ	Max	
T1	0.1	-	30	ms
T2	0.1	-	50	ms
T3	200	-	-	ms
T4	10	-	-	ms
T5	0.1	-	50	ms
T6	-	-	300	ms
T7	500	-	-	ms



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b. Display color vs. input data signals

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color; the higher the binary input, the brighter the color. The table below provides a reference for color versus data input.

Color		Input color data																							
		Red								Green								Blue							
		MSB				LSB				MSB				LSB				MSB				LSB			
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red	Red(000) dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(001)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(002)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255) bright	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green	Green(000)dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green(002)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green(255)bright	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Blue	Blue(000) dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(002)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue(255) bright	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

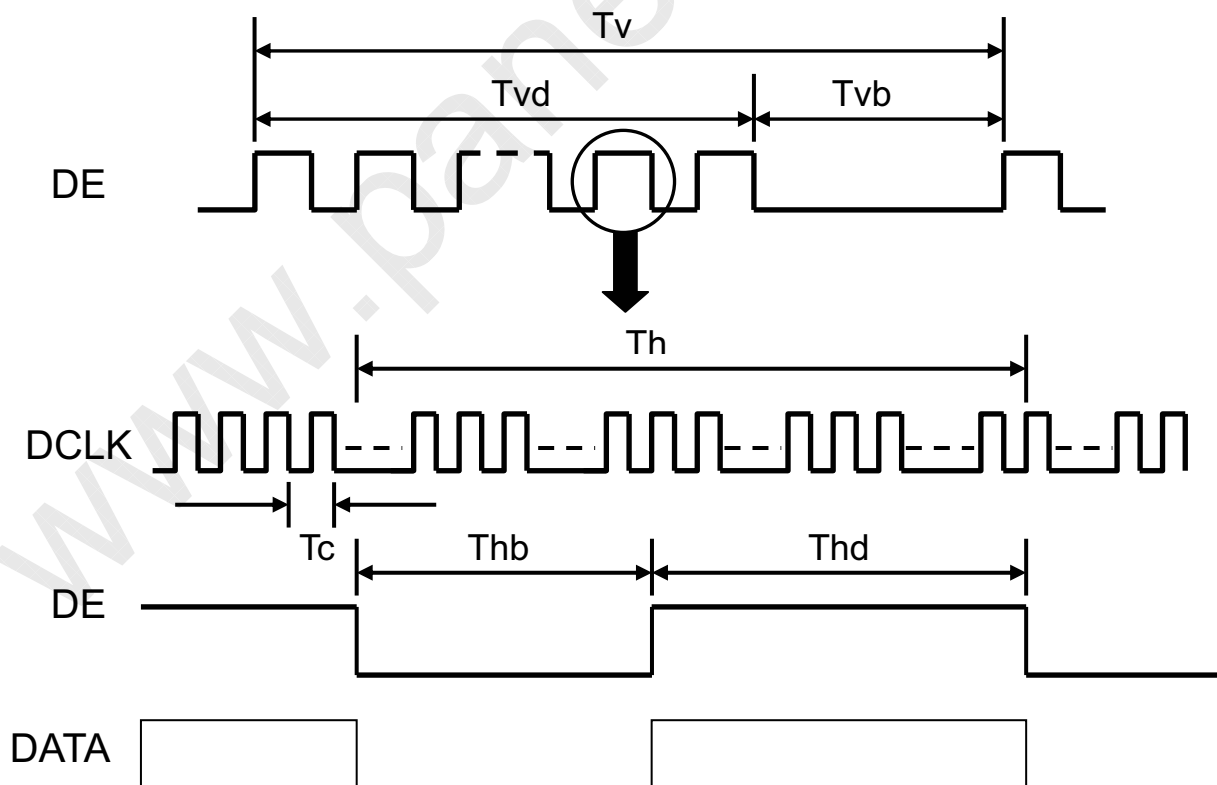
c. Input signal timing

Support Input Timing Table

	Item	Description	Min.	Typ.	Max.	Unit
Clock	Dclk	period	11.63	12.5	20	nS
		frequency	50	80	86	MHz
Vertical	T_{V_TOTAL}	V total line number	776	810	1015	T_{H_TOTAL}
	T_{V_DATA}	Data duration	—	768	—	T_{H_TOTAL}
	T_{VB}	V-blank	8	42	247	T_{H_TOTAL}
	f_V	frequency	47	60	63	Hz
Horizontal	T_{H_TOTAL}	H total pixel number	1503	1648	2000	DCIk
	T_{H_DATA}	Data duration	—	1366	—	DCIk
	T_{HB}	H-blank	137	282	634	DCIk

Note: Because this module is operated by DE only mode, Hsync and Vsync input signals should be set to low Logic level or ground. Otherwise, this module would operate abnormally.

INPUT SIGNAL TIMING DIAGRAM



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d. Display Position

D(1, 1)	D(2, 1)		D(683, 1)		D(1365, 1)	D(1366, 1)
D(1, 2)	D(2, 2)		D(683, 2)		D(1365, 2)	D(1366, 2)
⋮			⋮		⋮	⋮
D(1, 384)	D(2, 384)		D(683, 384)		D(1365, 384)	D(1366, 384)
⋮			⋮		⋮	⋮
D(1, 767)	D(2, 767)		D(683, 767)		D(1365, 767)	D(1366, 767)
D(1, 768)	D(2, 768)		D(683, 768)		D(1365, 768)	D(1366, 768)

e. Backlight driving conditions

Electrical specification

(Ta=25°C)

Item	Symbol	Min.	Typ.	Max.	Unit	Test Condition	Remark
Input voltage	V_{IN}	22.8	24.0	25.2	V		
Input Current (Stable on)	I_{IN}	-	3.15	3.29	A	$V_{IN}=24V$, $V_{DIM}=3.3V$ (or $P_{DIM}=100\%$) $I_L=12.0mA$	
Input Power (Stable on)	P_c	-	75.6	79	W	$V_{IN}=24V$, $V_{DIM}=3.3V$ (or $P_{DIM}=100\%$) $I_L=12.0mA$	
Inrush Current	I_{Rush}	-	-	7	A	$V_L=24V$	Note 1
CCFL lamp current	I_L	11.5	12.0	12.5	mArms	$V_{IN}=24V$, $V_{DIM}=3.3V$ (or $P_{DIM}=100\%$) $I_L=12.0mA$	Note 2
On/Off Control Voltage	ON	V_{BLON}	2.0	-	5.0	V	
	OFF		0.0	-	0.8	V	
External PWM Dimming Control Voltage	HI	V_{PDIM}	2.0	-	5.0	V	Duty On
	LO		0.0	-	0.8	V	Duty Off
Analog Dimming Control Voltage	V_{DIM}	0	-	3.3	V	Min dimming duty:0V Max dimming duty:3.3V	
Minimum Dimming Duty Ratio	D_{PWM}	10	20	-	%		Note 3
PWM Dimming Frequency	F_{PWM}	150	160	170	Hz		
Oscillation Frequency	F_o	61	63	65	KHz		
Lamp life time		50,000	-	-	Hr		Note 4

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Note 1: Measurement condition Rising time = 20 ms (V_{IN} : 10%~90%).

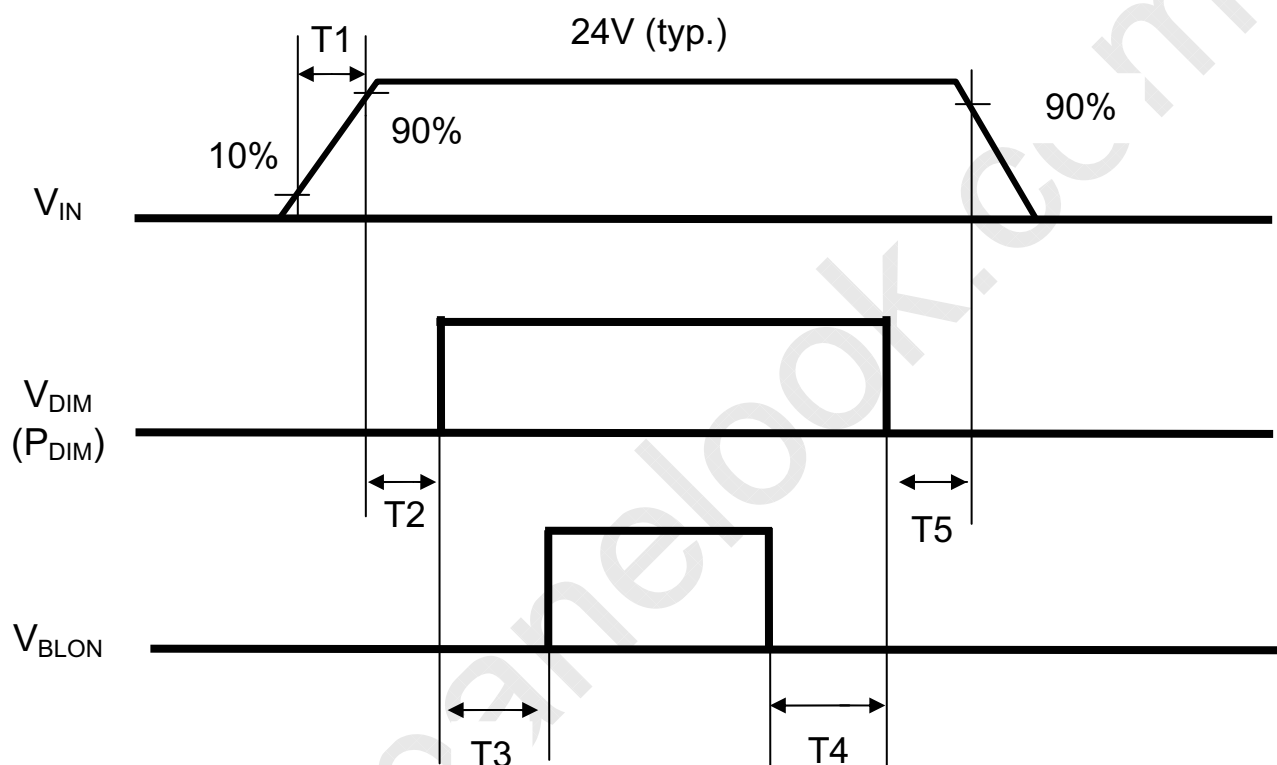
Note 2: The lamp current is measured by using AC current probe (High voltage side) and the current value is average.

Note 3: (1) Uniformity and flicker does not guarantee when the dimming control under 20%.

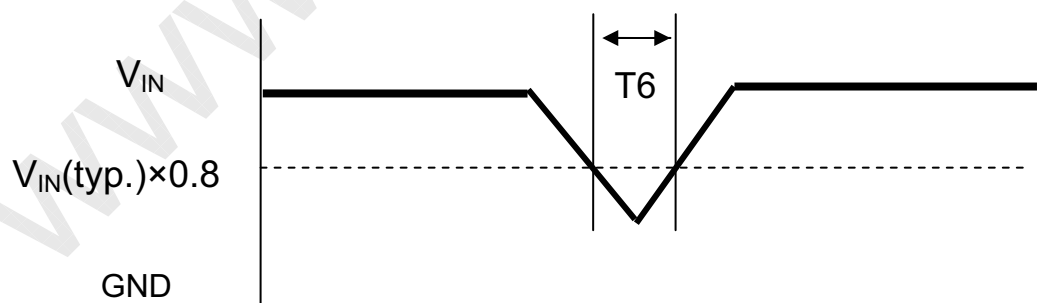
(2) 10% dimming function is okay, no shutdown occur.

Note 4: Life time is defined as the time when brightness of a lamp unit itself becomes 50% or less than its original value.

Note : Power sequence for Inverter which is show as below:



Deep condition for Inverter





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Parameter	Value			Unit
	Min	Typ	Max	
T1	20	-	-	ms
T2	50	-	-	ms
T3	0	-	-	ms
T4	0	-	-	ms
T5	0	-	-	ms
T6	-	-	10	ms

Input specification

Pin no.	Symbol	Description
1	V _{IN} (Main Power)	Input 24.0 VDC
2	V _{IN} (Main Power)	Input 24.0 VDC
3	V _{IN} (Main Power)	Input 24.0 VDC
4	V _{IN} (Main Power)	Input 24.0 VDC
5	V _{IN} (Main Power)	Input 24.0 VDC
6	GND	Ground
7	GND	Ground
8	GND	Ground
9	GND	Ground
10	GND	Ground
11	Reserved	INL internal use. Keep Open.
12	V _{B_{LO}N} (Enable Pin)	BL On/Off control signal. OFF: 0~0.8V ON: 2~5V
13	V _{DIM}	Analog dimming control Min. dimming duty:0V Max. dimming duty:3.0~3.3V
14	P _{DIM}	External PWM dimming control (OFF: 0~0.8V ON: 2~5V, Duty: 10%~100%)

Note: 1. When use PIN13 (V_{DIM}), PIN14 (P_{DIM}) must open.2. When use PIN14 (P_{DIM}), PIN13 (V_{DIM}) must open.3. PIN13 (V_{DIM}) and PIN14 (P_{DIM}) can not open at the same time.



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C. Optical specifications

Item	Symbol	Condition	Specification			Unit	Remark
			Min.	Typ.	Max.		
G to G Response time	T _y	$\theta = 0^\circ$	-	8.5	14	ms	Note 2
Contrast ratio	CR	$\theta = 0^\circ$	2400	3000	-		Note 1,3
Viewing angle	Top	$CR \geq 10$	-	89	-	deg.	Note 1,3,5
	Bottom	$CR \geq 10$	-	89	-		
	Left	$CR \geq 10$	-	89	-		
	Right	$CR \geq 10$	-	89	-		
Brightness (Center)	Y _L		360	450	-	Nits	Note 1,4
Color chromaticity(CIE)	W _x	$\theta = 0^\circ$	-0.03	0.280	+0.03		Note 1
	W _y			0.290			
	R _x			0.634			
	R _y			0.345			
	G _x			0.287			
	G _y			0.613			
	B _x			0.146			
	B _y			0.061			
White uniformity (9)	δ_w		0.75	0.80	-		Note 1,6
Cross talk	Ct		-	-	2%		Note 7

Note : 1 Ambient temperature = 25°C.

2.To be measured in dark room after backlight warm up 30 minutes.

Note 1: To be measured with a viewing cone of 2°by Topcon luminance meter BM-5A.

Note 2: Note 2: G to G Response Time:

Response time T_y is the average time required for display transition by switching the input signal for six luminance ratio (0%,20%,40%,60%,80%,100% brightness matrix) and is based on fv=60Hz to optimize.

	0%	20%	40%	60%	80%	100%
0%		t0%-20%	t0%-40%	t0%-60%	t0%-80%	t0%-100%
20%	t20%-0%		t20%-40%	t20%-60%	t20%-80%	t20%-100%
40%	t40%-0%	t40%-20%		t40%-60%	t40%-80%	t40%-100%
60%	t60%-0%	t60%-20%	t60%-40%		t60%-80%	t60%-100%
80%	t80%-0%	t80%-20%	t80%-40%	t80%-60%		t80%-100%
100%	t100%-0%	t100%-20%	t100%-40%	t100%-60%	t100%-80%	

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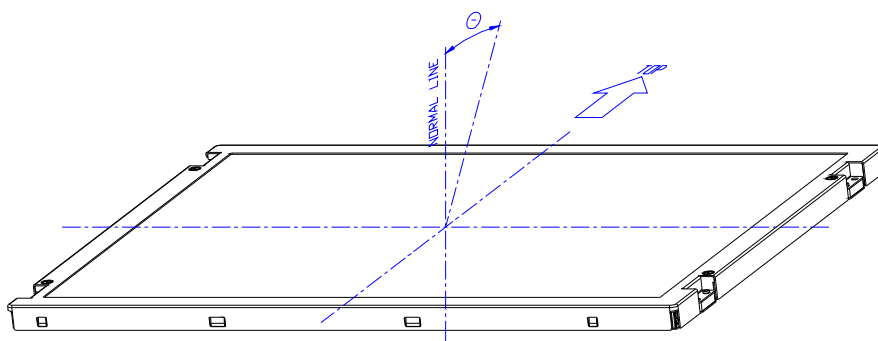
Note 3: Definition of contrast ratio:

Contrast ratio is calculated by the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the "white" state}}{\text{Brightness on the "black" state}}$$

Note 4: Driving conditions for CCFL: $I_L = 12 \text{ mA}$, 63 KHz Frequency.

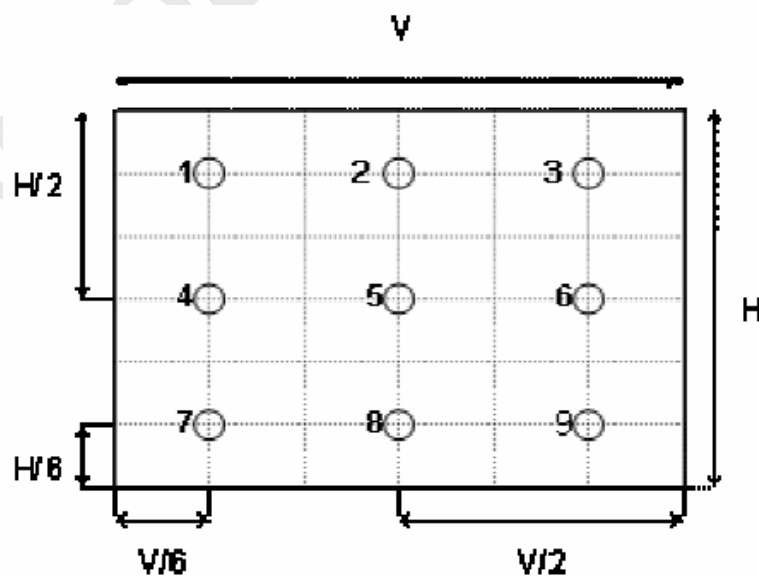
Note 5: Definition of viewing angle



Note 6: Definition white uniformity:

Luminance are measured at the following nine points (P1~P9).

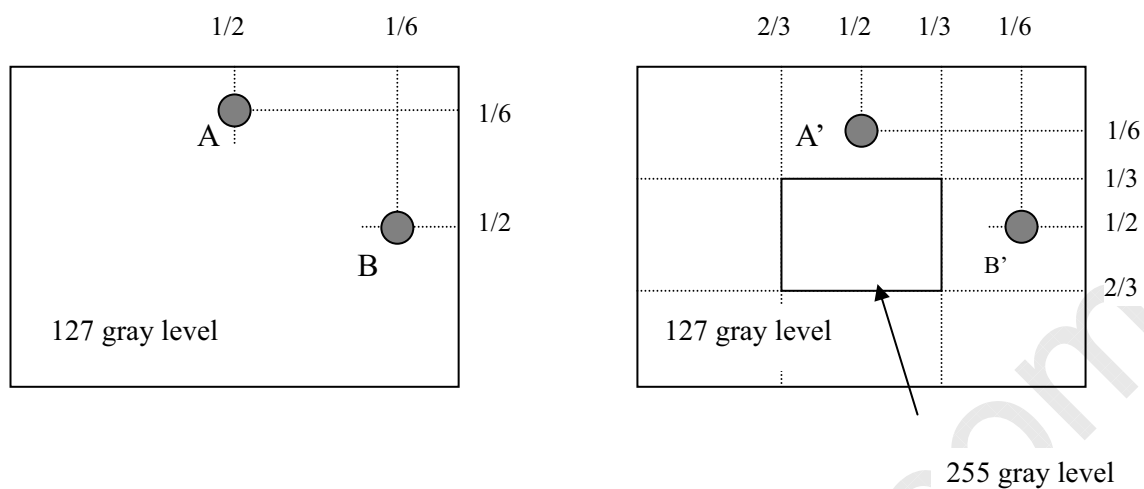
$$\delta_w = \frac{\text{Minimum Brightness of nine points (P1~P9).}}{\text{Maximum Brightness of nine points (P1~P9).}}$$



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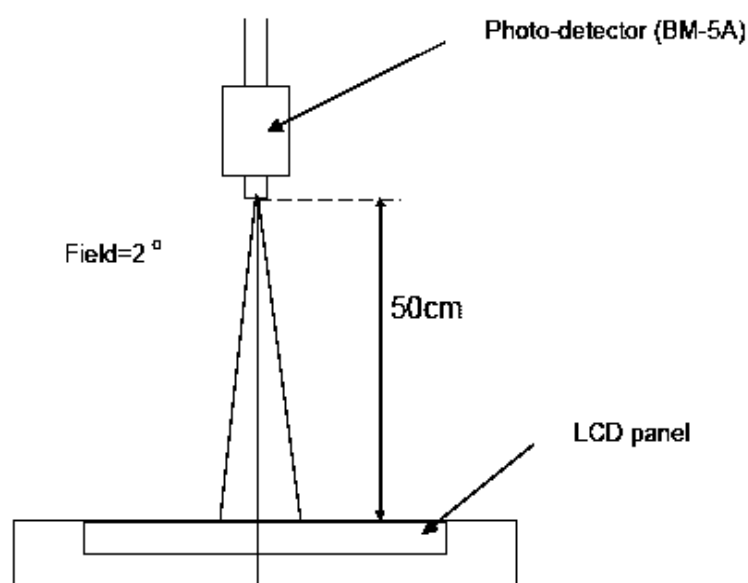
Note 7:



$$\frac{|L_A - L_{A'}|}{L_A} \times 100\% = 2\% \text{ max.}, L_A \text{ and } L_{A'} \text{ are brightness at location A and A'}$$

$$\frac{|L_B - L_{B'}|}{L_B} \times 100\% = 2\% \text{ max.}, L_B \text{ and } L_{B'} \text{ are brightness at location B and B'}$$

Note 10: Optical characteristic measurement setup.



**D. Reliability test items**

Test Item	Test Condition	Judgment	Remark
High temperature storage	60°C, 240Hrs	Note 1	Note 2
Low temperature storage	-20°C, 240Hrs	Note 1	Note 2
High temperature operation	50°C, 240Hrs	Note 1	Note 2
Low temperature operation	0°C, 240Hrs	Note 1	Note 2
Vibration (non-operation)	Vibration level : 1.5G Bandwidth : 10-300Hz Waveform : sine wave, sweep rate : 10min 30 min for each direction X, Y, Z (1.5 Hrs in total)	Note 1	Note 2
Mechanical Shock (non-operation)	Shock level : 50G, 11ms Waveform : Half sine wave Direction : $\pm X$, $\pm Y$, $\pm Z$ One time each direction	Note 1	Note 2
Vibration test (with carton)	Random Wave (1.5 Grms 10~200Hz) 30mins / Per each X.Y.Z axes	Note 1	Note 2
Drop test (with carton)	Height : 38cm 1corner; 3edges; 6 surfaces	Note 1	Note 2
MTBF Demonstration	50,000 hours with confidence level 90%	Note 1	Note 3

Note1: Pass: Normal display image with no obvious non-uniformity and no line defect.

Partial transformation of the module parts should be ignored.

Fail: No display image, obvious non-uniformity, or line defects.

Note2: Evaluation should be tested after storage at room temperature for two hours.

Note 3: The MTBF calculation is based on the assumption that the failure rate distribution meets the Exponential Model (CCFL excluded)

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E. Safety

(1) Sharp Edge Requirements

There will be no sharp edges or corners on the display assembly that could cause injury.

(2) Materials

a. Toxicity

There will be no carcinogenic materials used anywhere in the display module. If toxic materials are used, they will be reviewed and approved by the responsible InnoLux Toxicologist.

b. Flammability

All components including electrical components that do not meet the flammability grade UL94-V1 in the module will complete the flammability rating exception approval process. The printed circuit board will be made from material rated 94-V1 or better. The actual UL flammability rating will be printed on the printed circuit board.

c. Capacitors

If any polarized capacitors are used in the display assembly, provisions will be made to keep them from being inserted backwards.

F. Display quality

The display quality of the color TFT-LCD module should be in compliance with the Innolux's Incoming inspection standard.

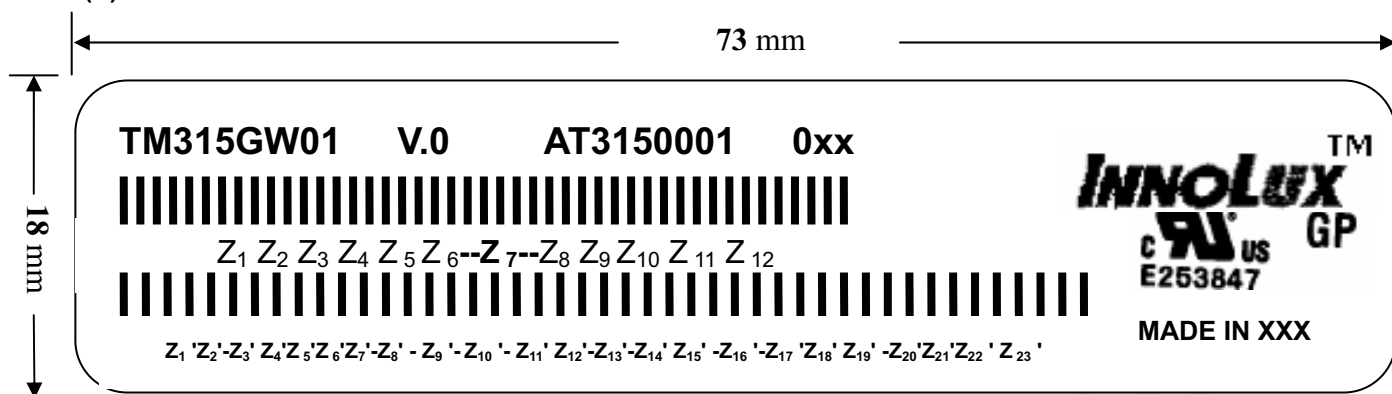
G. Handling precaution

The Handling of the TFT-LCD should be in compliance with the Innolux's handling principle standard.



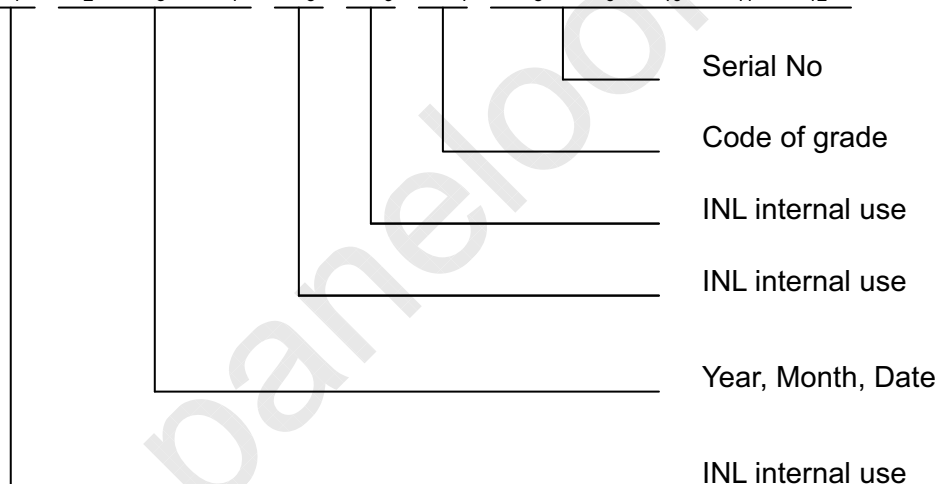
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H. Label**(1) Module Label**

(a) Model Number: TM315GW01

(b) Version: V.0

(c) Serial ID I: Z₁ Z₂ Z₃ Z₄ Z₅ Z₆ Z₇ Z₈ Z₉ Z₁₀ Z₁₁ Z₁₂

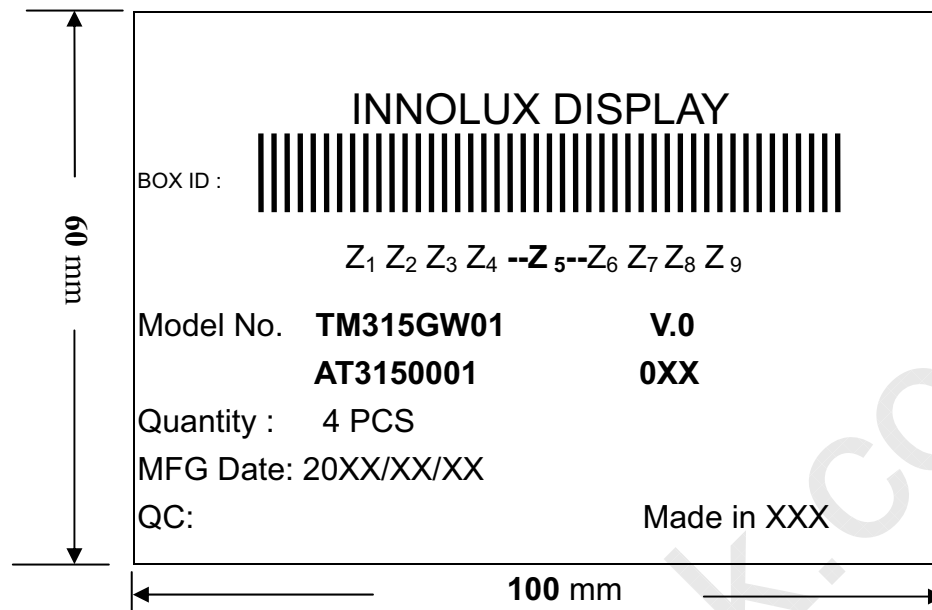
Serial ID includes the information as below:

1. Manufactured Date: Year: 0~9, for 2000~2009
2. Month: 1~9 & A~C for Jan.~Dec.
3. Date: 1~9 & A~Z (exclude I, O, Q, U) for 1st~31th
4. Code of grade: 1, 2, 3, 5, E
5. Serial No: Module manufacture sequence no

(d) Serial ID II (INL internal use)

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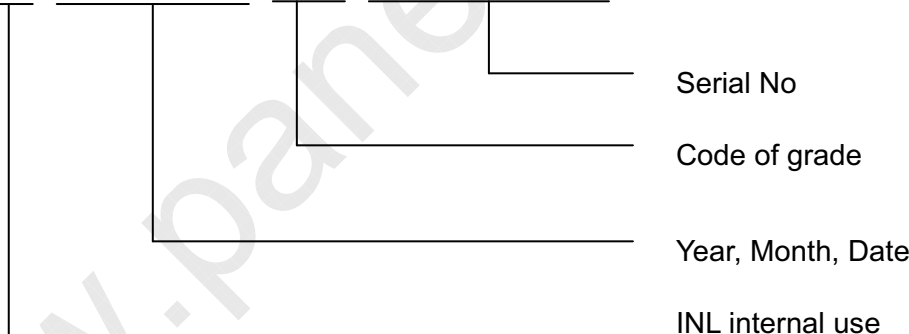
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(2) Carton Label

(a) Model Number: TM315GW01

(b) Version: V.0

(c) Packing quantity: 4 pcs

(d) Serial ID: Z₁ Z₂ Z₃ Z₄ Z₅ Z₆ Z₇ Z₈ Z₉

Serial ID includes the information as below:

(a) Manufactured Date: Year: 0~9, for 2000~2009

Month: 1~9 & A~C for Jan.~Dec.

Date: 1~9 & A~Z (exclude I, O, Q, U) for 1st~31th

(b) Code of grade: 1,2, 3, 5, E

(c) Serial No: Module packing sequence no

I. Mechanical drawing

